



SEMINARS

WORLDWIDE
LIBRARY

JAN 25 1968

HARVARD
UNIVERSITY

**NEW PANAMIC NUDIBRANCHS
(GASTROPODA; OPISTHOBRANCHIA)
FROM THE GULF OF CALIFORNIA**

JAMES R. LANCE

TRANSACTIONS

**OF THE SAN DIEGO
SOCIETY OF
NATURAL HISTORY**

VOL. 15, NO. 2, 8 JANUARY 1968



Plate 1. *Nembrotha hubbsi*, sp. nov. Kodachrome by Wesley M. Farmer.



Plate 2. *Acanthodoris stobleri*, sp. nov. Ektachrome by Walter E. Harvey and James R. Lance.

NEW PANAMIC NUDIBRANCHS
(GASTROPODA: OPISTHOBRANCHIA)
FROM THE GULF OF CALIFORNIA

JAMES R. LANCE¹

ABSTRACT

Three new species of shell-less euthyneuran mollusks from the northern part of the Panamic faunal province are described. These are: *Chromodoris fayeae* sp. nov., *Acanthodoris stobleri* sp. nov. and *Nembrotha hubbsi* sp. nov. The last taxon represents the first record for this genus in the eastern Pacific. Other northeastern Pacific species of the treated genera are compared and discussed. Anatomical details and geographic ranges are provided.

Although some 1600 species of mollusks have been reported from the Panamic faunal province (Keen, 1958: 7), only 20 species of nudibranchs (Order Nudibranchia) are known from the region. This small number of species reflects a general disinterest of malacologists in observing and collecting shell-less mollusks and, in part, the inaccessibility of the region, rather than a paucity of material. Expeditions to the Gulf of California undertaken between 1962 and 1967, by the San Diego Natural History Museum, the Santa Barbara Museum of Natural History, and the writer, have collected large numbers of these animals. These collections apparently include many new species, of which three are described below. Numerous individuals of each species from different geographic localities have been compared and color transparencies have been made of the animals in life. The illustrations portray typical individuals from the obtained samples. The systematic treatment follows Odhner's (1939) revision.

SPECIES ACCOUNTS

Family Dorididae

Subfamily Chromodoridinae

Chromodoris fayeae sp. nov.

Type material. — Holotype: California Academy of Sciences, Department of Invertebrate Zoology no. 314. Collected 6 March 1966 in the rocky, lower intertidal region at Santa Cruz, Nayarit, Mexico (approximately ten miles south of San Blas); 21°30'N, 105°16'W. Paratypes: Santa Barbara Museum of Natural History nos. 19669 (two specimens collected 6 March 1966) and 25000 (15 specimens collected 4 February 1967).

Description. — The largest specimen measured 47 mm long and 11 mm broad while crawling actively. The notum is moderately expanded in front and behind, narrower in the middle and completely covers the foot except posteriorly where the pointed tail protrudes (Fig. 1). The notal surface is soft and smooth, its margins entire when the animal is gliding, but it may become crenulate when the animal is irritated. The vertical sides of the body are completely covered by the notum, and are not partially exposed as in *Hypselodoris californiensis* (Bergh, 1879).

The spectacular color pattern of *C. fayeae* at once distinguishes it from all other described northeastern Pacific opisthobranchs. The general ground color is pure white, not the colorless translucency of many other species. Three distinct, uninterrupted lines of contrasting color occur around the notal brim: an inner band of opaque white, which contrasts with the pellucid white of the body, a central line of vivid red, and a

¹Stazione Zoologica di Napoli, Present address: 746 Agate St., San Diego, California 92109.

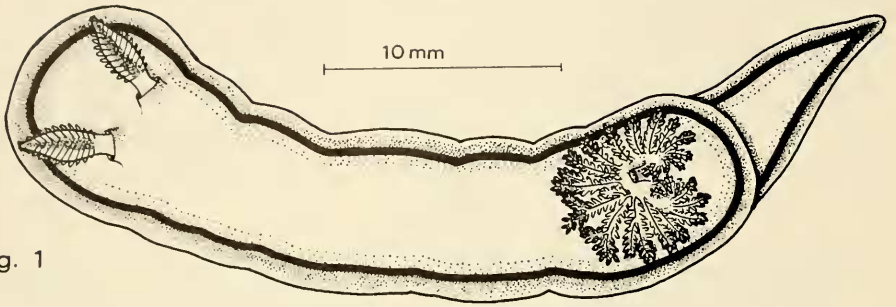


Fig. 1

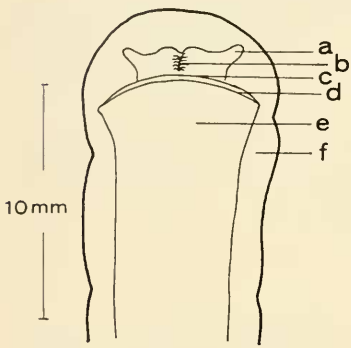


Fig. 2

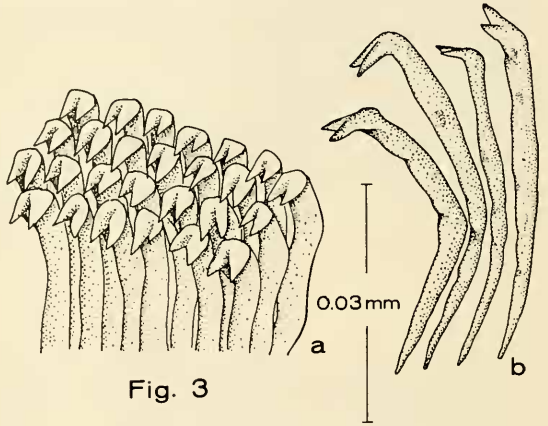


Fig. 3

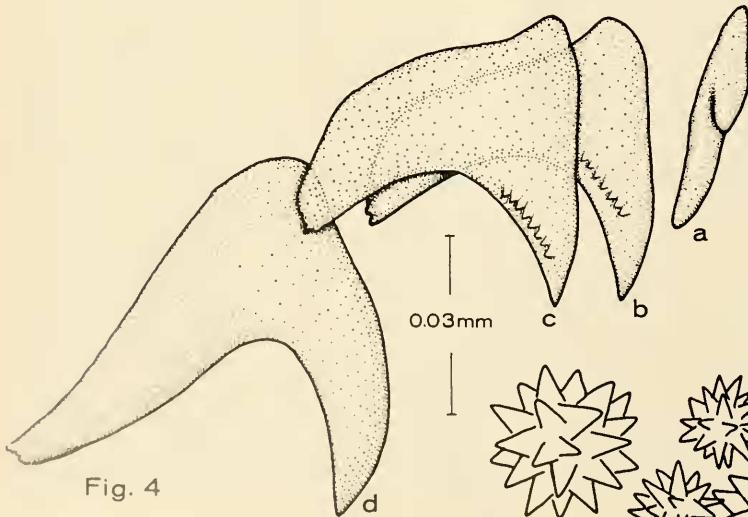


Fig. 4

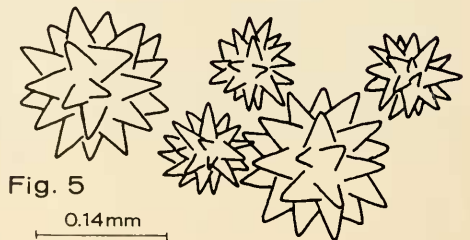


Fig. 5

marginal edging of brilliant yellow. This same pattern is repeated around the foot margins. It is most intense posteriorly and gradually fades anteriorly and disappears at about the level of the rhinophores. The inner and outer surfaces of the distal portions of the branchial stems are red. The perfoliate regions of the rhinophores are colored a similar but darker red, especially on their anterior and posterior axial ridges. Some preserved specimens retained a faint trace of red after one year in 70 per cent isopropyl alcohol, but this was lost after the second year. The opaque white and yellow bands faded two months after preservation.

Anteriorly the foot is expanded and produced into sharp corners (Fig. 2). Its frontal margin is rounded, deeply bilabiate and entire, not notched. The lateral margins are nearly parallel except posteriorly, where they converge to form a pointed tail with a low dorsomedian crest. The anterolateral corners of the head are produced into short, digitiform tentacles, between which the mouth appears as a longitudinal slit (Fig. 2a, b).

The rhinophores are completely retractile into chambers which bear sheaths with low, smooth margins. These sensory organs are relatively short but deeply perfoliate with 21 lamellae (in a 36 mm specimen) joined by a longitudinal septum on both the anterior and posterior faces.

The elegantly developed branchiae are simply pinnate, although some of the anterior primary stems may bifurcate distally. They are completely retractile within a cavity bearing a low, smooth margin and are disposed in an arc with enrolled extremities similar to those described and figured by Eliot (1904) for several species of Indo-Pacific chromodorids. The 24 to 32 branchiae gradually decrease in size toward the extremities of the enrolled arc. Except for momentary periods of quiescence, these appendages are continually in motion. The movement of each branchium is a rapid twitching from side to side and is entirely unlike the rhythmical circulatory pulsations observed in the respiratory appendages of many other cryptobranch dorids. Eliot (1904) has reported similar branchial motion for *Chromodoris annulata*, *C. runcinata*, *C. tryoni* and *Casella atromarginata*. Gohar and Aboul-Ela (1957) have observed sideward vibrations in *Chromodoris pulchella* and *C. annulata* from the Red Sea. Such a respiratory adaptation is obviously advantageous to organisms inhabiting waters low in dissolved oxygen.

The labial armature consists of a horn-colored, circular band of minute rodlets arranged in an irregular series. Each rodlet is flexed near its midpoint (from nearly straight to about 90°) and terminates in a bifid cusp (Fig. 3b). From above, only the bifid hooks and portions of their supporting rods are evident (Fig. 3a). Bergh (1905, pl. 16) figures similar labial elements for a number of Indo-Pacific chromodorids.

The radula is broad and deeply grooved medially. The teeth and basal membrane are colorless in freshly killed individuals. The radular formula from a typical specimen is 129 x 42. 1. 42. An average dental row consists of a dwarf but robust rachidian tooth with a blunt cusp (Fig. 4a) flanked on each side by a series of unicuspidate lateral teeth that very gradually increase in size outward (Figs. 4b,c,d). The inner laterals bear a linear series of 6 to 8 denticles on the outer sides of the cusps and fewer on the inner. The denticles decrease in number outward and become obsolete at about the level of the 30th tooth. The outermost laterals are smooth hamate hooks with elongated bases.

White, stellate spicules of two principal size classes were found imbedded in the

Figures 1-5. *Chromodoris fayeae*. 1. Dorsal aspect of animal in life. 2. Anteroventral aspect of animal in life: a. oral tentacle; b. mouth; c. upper foot lip; d. lower foot lip; e. foot; f. hyponotum. 3. Elements of the labial armature: a. top view of exposed portion of elements *in situ*; b. lateral view of three typical elements freed from matrix. 4. Representative teeth from left side of 60th row of radula: a. rachidian; b. 1st lateral; c. 2nd lateral; d. outermost tooth (42nd). 5. Representative spicules from innermost layers of notal epidermal tissue; the two size classes are illustrated.

inner epidermal layers of the notum in freshly killed specimens (Fig. 5). They were concentrated in a loose band circumscribing the margins of the body cavity. The larger elements attained a maximum diameter of 140μ while the smaller were about half that size.

No trace of a penial armature was found.

Distribution. — This species has been taken on the open Pacific coast of mainland Mexico and from several localities within the Gulf of California: (1) Bahía San Luis Gonzaga, 23 September 1962, 1 specimen; (2) Isla Ángel de la Guarda, 1957, 7 specimens; (3) Isla Santa Cruz, 26 June 1964, 9 specimens; (4) Mazatlán (yacht club cove), 20 December 1961, 2 specimens; (5) Santa Cruz, Nayarit (type locality), 6 March 1966, 4 specimens; 4 February 1967, 16 specimens; (6) Tentacatita, Jalisco, 6 February 1963, 1 specimen. Vertical distribution of the animals ranged from lower intertidal to 37 feet.

Name. — The specific patronym *fayae* was chosen to honor Faye B. Howard, Research Associate in Conchology, Santa Barbara Museum of Natural History, in recognition of her many outstanding contributions to our knowledge of Panamic mollusks.

Discussion. — Following the opinions of Odhner (1957: 250-253), Gohar and Aboul-Ela (1957: 204), Marcus and Marcus (1960: 901), Burn (1962: 152), Farmer (1963: 81) and Marcus and Burch (1965: 247-248), I reject the generic name *Glossodoris* Ehrenberg, 1831, in favor of *Chromodoris* Alder and Hancock, 1855, for species of Chromodoridinae with unicuspidate lateral teeth, and *Hypselodoris* Stimpson, 1855, for those bearing bicuspidate ones. This choice is necessary because the radula of Ehrenberg's *Glossodoris* has never been examined. For a review of this controversy see Odhner (1957).

According to these views the present species must be assigned to *Chromodoris* on the basis of its gross morphology, dwarf rachidian, and unicuspidate radular teeth. Marcus (1965: 272-273) observed that elements of the labial armature, which generally consist of rodlets, either simple or terminating in a bifid hook, or are scale-like platelets, are of taxonomic significance in the Chromodoridinae. Thus, the flexed rodlets with terminal bifid hooks of the present species further substantiate its generic assignment.

This is the third endemic chromodorid described from the Panamic region.

Family Gymnodorididae
Nembrotha hubbsi sp. nov.

(Plate 1)

Type material. — Holotype: California Academy of Sciences, Department of Invertebrate Zoology no. 315. Collected 21 April 1962 at a depth of 10 m near Isla la Ventana, Bahía de Los Ángeles, Baja California, Mexico; $28^{\circ}55'N.$, $113^{\circ}32'W.$ Paratypes: California Academy of Sciences, Department of Invertebrate Zoology no. 316 (one specimen); Santa Barbara Museum of Natural History no. 23705 (one specimen). Collecting data for paratypes same as holotype.

Description. — Dimensions of actively crawling individuals observed by Farmer and Sloan were: length, 38, 32, 21, 25, 19 mm; width, 9, 9, 4, 4, 3 mm; height, 11, 11, 3.5, 6, 4 mm, respectively. However, one preserved specimen from Isla la Ventana measured 54 mm in length, indicating that live animals may grow to be at least 60-70 mm long.

The general body shape is limaciform, rounded in front, highest in the cardiac region and tapering to a pointed tail. The surface is smooth, not furnished with tubercles, papillae, or extra-branchial processes. The head region is provided with a vestigial frontal veil which passes around the anterolateral corners and becomes obsolete at about the level of the rhinophores. Distinct pallial ridges are not present.

The striking coloration of this species at once separates it from all other north-eastern Pacific nudibranchs. The background color is a deep yellow ochre. Five longi-

tudinal cerulean blue stripes of varying width, bordered on each side by a narrow line of intense blue-black or black, occur on each side of the body and extend for most of the length. A similar stripe arises medially in the head region, passes back between the rhinophores, is interrupted in the branchial region, and continues posteriorly. Most of the lines converge on the tip of the tail. The inner surfaces of the branchiae are dark blue-black; their outer faces a deep yellow ochre with a blue line running up the primary stem. The rhinophores are dark blue-black. The general color pattern is retained after five years in 70 per cent alcohol.

The prominent rhinophores are perfoliate and retractile within chambers bearing low, smooth, upstanding sheaths. The number of rhinophoral lamellae was not determined.

There is a circlet of 5 branchiae located medially on the posterior slope of the cardiac hump. As in other gymnodorids, the branchiae are not retractile within a subepidermal chamber but are highly contractile. Due to maceration, the configuration of the finer structures of the branchiae could not be determined.

The radular morphology was determined from one of the larger specimens (41 mm preserved). The formula at the level of the 10th row was 35 x 3-4. 1. 1. 1. 3-4. The rachidian teeth (Fig. 6a) consist of thickened arched bases with the extremities derachidians reported for other species of *Nembrotha* (Eales, 1938: 96; Marcus, 1956: 47). developed into upstanding subequal prongs, and are much more robust than the delicate A well developed central cusp, as in *N. gracilis* Bergh, 1877 (pl. 56) and *N. rubropapulosa* Bergh, 1905 (pl. 18) is lacking in *N. hubbsi*. The prominent first laterals are U-shaped with asymmetrical extremities terminating in a pair of long sharp points (Fig. 6b). The outer side of the shoulder bears a grooved process which apparently hinges with the first marginal plate. The 3 to 4 marginal plates are greatly reduced irregular triangles and decrease in size outwards (Fig. 6c, d, e, f). The attached bases of the rachidians and first laterals, and upper portions of the outer marginal plates are a dark yellowish-brown; the free portions are colorless. A labial cuticle was not found.

Mr. Farmer (personal communication) has observed this species swimming in an aquarium by undulating its body from side to side in a manner similar to that of *Flabellinopsis iodinia* (Cooper, 1862).

Distribution.— To date this species has been collected only in the northern part of the Gulf of California. Five specimens were obtained by Prof. Hubbs and party from: (1) Isla la Ventana (type locality), 3 specimens; (2) reef between Isla la Ventana

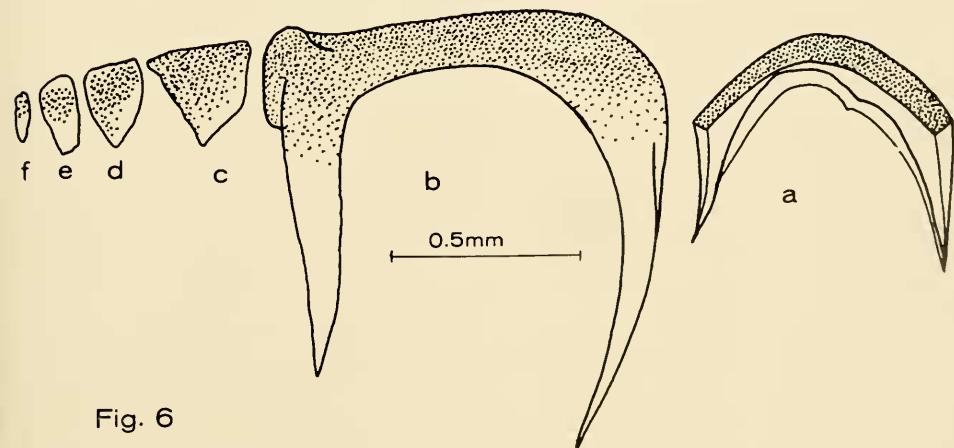


Fig. 6

Figure 6. *Nembrotha hubbsi*. Typical teeth from 10th row of radula: a. rachidian; b. 1st lateral; c-f. marginals.

and Isla Cabeza de Caballo, 1 specimen; (3) Punta Que Malo, 1 specimen. All localities are within Bahía de los Angeles. Additional material was collected by Wesley Farmer and John Sloan in May, 1962, and March, 1963, at Isla Cerralvo, Bahía de los Angeles, and Puerto Refugio on Isla Ángel de la Guarda. I have also tentatively identified this species from color motion pictures taken in the La Paz area during a recent California Academy of Sciences expedition to the Gulf of California.

Name. — The specific name *hubbsi* was chosen to honor Prof. Carl L. Hubbs of the Scripps Institution of Oceanography, who first brought this elegant animal to my attention.

Discussion. — Bergh (1877) erected the genus *Nembrotha* to accommodate a number of colorful, limaciform gymnodorids from the western Pacific, principally the Philippine Sea. This genus differs from the related *Gymnodoris* Stimpson, 1855 (= *Trevelyana* Keelart, 1858) by possessing rachidian teeth, reduced number of laterals, fewer gills, and absence of a prostatic portion of the vas deferens. This last character, however, applies only at the specific level as a prostate has been demonstrated to occur in *N. lineolata* (see Eales, 1938: 97) and *N. nigerrima* (see Macnae, 1957: 361).

Burn (1962: 98) erected *Tambja* for those species of *Nembrotha* bearing a rachidian tooth in the form of a simple rectangular plate, bifid first lateral, a highly reduced number (3 to 4) of marginal teeth, and a pair of short extra-branchial processes. This last character, however, is neither figured nor described for *Tambja sagamiana* (= *N. sagamiana* Baba, 1955) contrary to Burn's (*loc. cit.*) statement.

The radula of *N. hubbsi* is most similar to that of *N. gracilis* Bergh, 1877 (pl. 56) and *N. rubropapulosa* Bergh, 1905 (pl. 18), but may be readily distinguished by the different configuration of the rachidian, lateral, and marginal teeth. Also, the color pattern is entirely different. Until a comprehensive review of the genus is undertaken, I prefer to assign the present species to *Nembrotha* (*sensu lato*). This species is the first eastern Pacific representative of this colorful tropical genus.

Family Onchidorididae
Acanthodoris stohleri sp. nov.
(Plate 2)

Type material. — Holotype: California Academy of Sciences, Department of Invertebrate Zoology no. 307. Paratype: no. 308 at the same institution. Both specimens collected at Bahía San Luis Gonzaga (inner side of Isla Willard), Baja California, Mexico (20° 48'N., 114° 25'W.) on 5 February 1966 by Mr. Gale Sphon.

Description. — The largest specimen obtained from all collections measured, in life, 21 mm long and 11 mm broad. Average individuals were smaller: 14.5 mm long and 7.5 mm broad.

The body is typically acanthodoridiform; subovate, broader in front than behind (Fig. 7). The mid-dorsal region is somewhat arched and bordered all around by a wide, flat notal brim. A moderate number of upstanding, slender papillae, more or less equidistant from each other, cover the notum except around the margin. Although taller and shorter ones are intermingled, the latter occur more abundantly toward the margins. In the color plate, the papillae are highly contracted.

The color pattern immediately distinguishes *A. stohleri* from all other described acanthodorids. In gross dorsal aspect, the notum is black with a wide, cherry-red margin. The notal papillae, rhinophore sheaths and rhinophores are of a similar but more intense shade of red. In detail the rhinophores are tipped distally with a highly contrasting yellowish-white pigment that also occurs sparingly as flecks on some of the notal papillae, branchiae, oral veil, at the junction of the foot and hyponotum, and on the notal surface. The foot is mostly colorless except for a few longitudinal streaks of black and red pigment. In most specimens the base of each papilla is surrounded by a colorless halo. Considerable variation in intensity and relative abundance of the pigments were

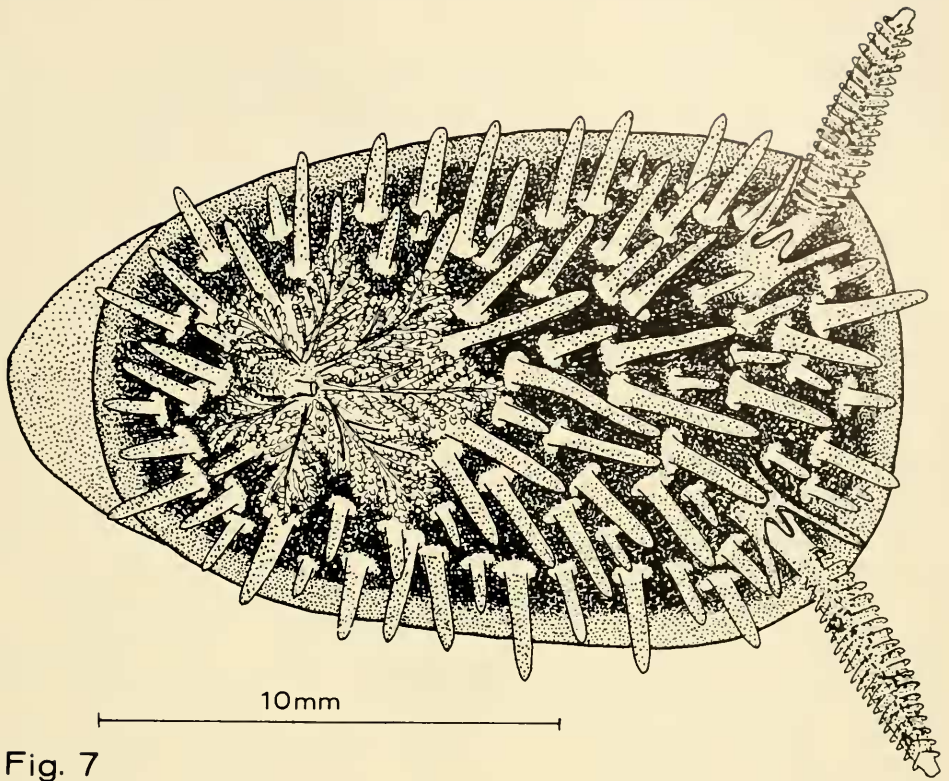


Fig. 7

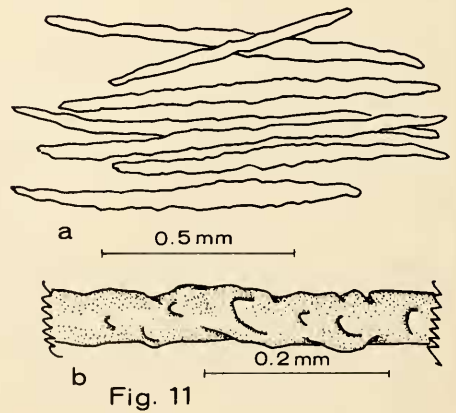
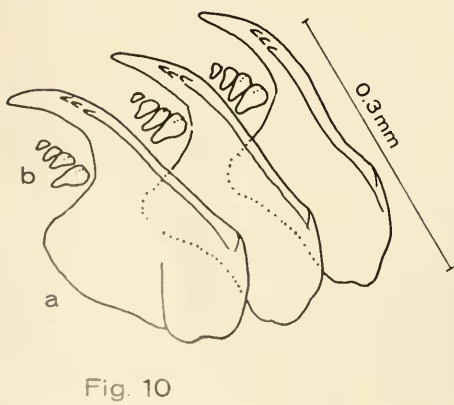
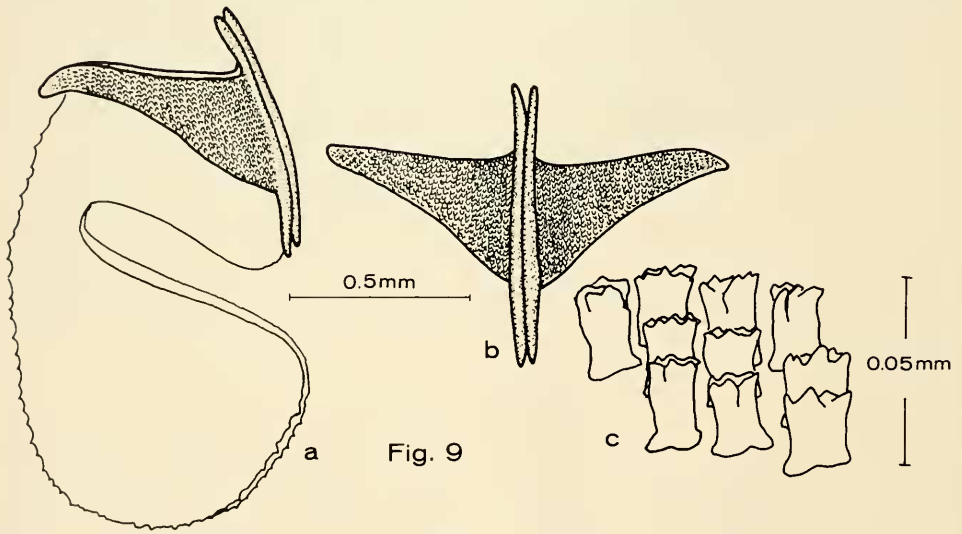
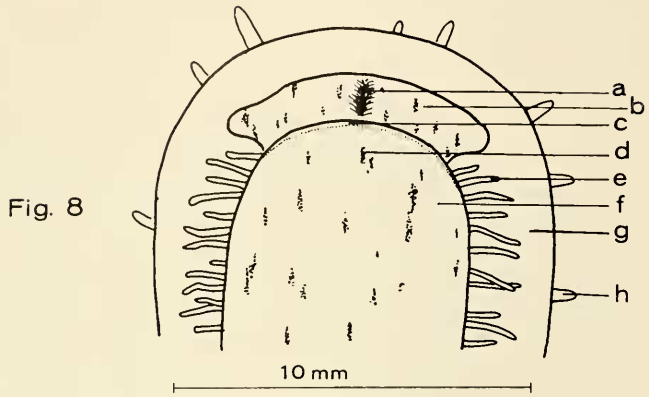
Figure 7. *Acanthodoris stobleri*. Dorsal aspect of animal in life.

observed but the over-all pattern and basic colors were constant. Specimens preserved one year in 70 per cent isopropyl alcohol retained most of the black and red pigments.

In ventral aspects (Fig. 8) the foot is about two-thirds the width of the notum and protrudes posteriorly as a rounded, flat tail. Its anterior margin is weakly bilabiate with the upper lip barely discernible (Fig. 8c). The margins are entire, not notched. The broad head region is produced into a semicircular veil with unilabiate margins and is very slightly wider than the greatest width of the foot (Fig. 8b). The anterolateral corners are expanded into blunt triangles.

As in other members of the genus, the retractile rhinophores are elongate and deeply perfoliate. In life they are directed forward and outward. About two-thirds of the length of each rhinophore is occupied by the conspicuous club, which bears 18 to 22 transverse lamellae joined anteriorly by a longitudinal septum. The rhinophore stalks are slightly inflated at their bases and the entire organs are capable of being retracted within upstanding sheaths which usually bear 1 to 4 elongate papillae similar in shape and length to those on the notum. Each rhinophore terminates distally in a knob free of lamellae.

The 6 to 7 bipinnate branchiae are separate at their bases and are contractile, but not retractile, within a subnotal chamber. They decrease in size posteriorly. Conspicuous white globular glands occur within the bases of the primary branchial stems. Unlike other acanthodorids for which data are available, the present species does not bear notal papillae within the area circumscribed by the branchial circlet. The anal opening occurs atop a conspicuous excretory papilla within the branchial arc. Under ten power magnification, rhythmically beating cilia may be observed on the inner distal face of the anal tube.



The labial disc is characteristic in shape, cuticular and mostly transparent (Fig. 9a). In a 14 mm specimen it measured 1.5 mm long. The margin joining the two halves is serrate. The upper portion of each component gives rise to a triangular area supported along its median margin by an elongated chitinous rod (Figs. 9a, b). The triangles are composed of rows of minute, horn-colored elements with bluntly denticulate distal margins (Fig. 9c). Each element is attached to the basement membrane by an imbedded, thickened base.

The radula is narrow, colorless, and 2 mm long in an average live specimen of 14 mm. The formula is 34×4 . 1. 0. 1. 4. The denticulation is similar to that of other acanthodorids: the first lateral is a large, erect hamate hook arising from a thickened base and bears 2 to 3 inconspicuous denticles about half way along the cusp (Fig. 10a). The four marginals (Fig. 10b) are wedge-shaped, greatly reduced, and decrease in size outwards.

The spicules, although few in number, are relatively large, attaining a length of 1.0 mm in a 14 mm live specimen. They are simple, thick rods with slightly nodulose surfaces and tapering ends and occur singly, not forming bundles or a reticulum (Fig. 11a, b). The greatest concentration is radially oriented around the notal margins, but they do not attain the edge thus leaving the brim free (Fig. 8e). Similar but smaller spicules are found scattered in the mid-dorsal integument and rhinophore bases.

The penis bears a series of spines, but details of the armature and other aspects of the reproductive system have not been determined.

Several individuals of the large collection made at Punta Diggs on 12 February 1967, and transported to Scripps Institution of Oceanography, deposited nidosomes (egg masses) on the aquarium walls within a few days after capture. Apparently the animals were undergoing a spawning cycle since many individuals were in a coital position when collected. Nidosomes, presumably belonging to this species, were common under or near stones harboring the nudibranchs. No evidence of reproductive activity of specimens collected during other seasons has been observed either in the field or in the aquarium.

The nidosome, as in many doridiform nudibranchs assumes the shape of a white ribbon, loosely coiled counterclockwise, attached by one edge to the substratum. The attached and free margins are of equal length resulting in erect, vertical sides. In general shape it resembles that of *Acanthodoris nanaimoensis* as figured by Hurst (1967: 257) except, curiously, her illustration depicts a dextrally-oriented spiral.

Of the nine nidosomes deposited, the simplest consisted of a single convolution, the largest of approximately two whorls. The pure white egg capsules contained a single egg each and were deposited in vertical rows within the colorless, jelly-like matrix. A typical nidosome measured 9 mm at its greatest diameter and 2.8 mm in height. No attempt was made to observe embryological development.

Distribution.— This species has been collected only within a very restricted geographical area along the northeastern shores of the Baja peninsula: (1) Bahía Percebú (about 15 miles south of San Felipe), 12 February 1965, 9 specimens; 26 November 1965, 1 specimen; (2) Punta Diggs, 12 February 1967, 37 specimens (egg masses present); (3) Puertecitos, 26 November 1964, 3 specimens, 19 March 1965, 7 speci-

Figures 8-11. *Acanthodoris stobleri*. 8. Anteroventral aspect of animal in life: a. mouth; b. oral veil; c. anterior foot margin; d. pigment streak; e. spicule (imbedded in hyponotum); f. foot; g. hyponotum; h. dorsal papilla. 9. Labial armature and elements: a. lateral aspect of the paired membranous plates; b. frontal view of primary supporting ribs and attached triangular basis anchoring labial elements; c. detail of elements. 10. Three half-rows from middle of radula: a. denticulate first lateral; b. the four successive marginals. 11. Spiculation: a. spicules from notal margin; b. detail of spicule surface.